

Historic, archived document

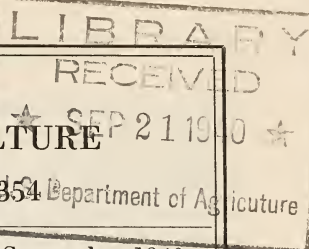
Do not assume content reflects current scientific knowledge, policies, or practices.

UNITED STATES
DEPARTMENT OF AGRICULTURE

Miscellaneous Publication No. 854 Department of Agriculture

Washington, D. C.

September 1940



A REVIEW OF THE PARASITIC WASPS OF THE ICHNEUMONID GENUS EXENTERUS HARTIG¹

By R. A. CUSHMAN, entomologist, Division of Insect Identification, Bureau of Entomology and Plant Quarantine

CONTENTS

	Page		Page
Introduction.....	1	<i>Exenterus marginatorius</i> (Fabricius).....	8
Key to species.....	2	<i>Exenterus claripennis</i> Thomson.....	9
<i>Exenterus diprionis</i> Rohwer.....	4	<i>Exenterus abruptorius</i> (Thunberg).....	9
<i>Exenterus affinis</i> Rohwer.....	5	<i>Exenterus oriolus</i> Hartig.....	10
<i>Exenterus loflyri</i> Viereck.....	5	<i>Exenterus canadensis</i> Provancher.....	10
<i>Exenterus tricolor</i> Roman.....	5	<i>Exenterus flavissimus</i> , new species.....	12
<i>Exenterus adpersus</i> Hartig.....	6	<i>Exenterus pini</i> , new species.....	13
<i>Exenterus hullensis</i> Provancher.....	7	<i>Exenterus tsugae</i> , new species.....	13
<i>Exenterus vellicatus</i> , new species.....	7		

INTRODUCTION

The discovery within the past several years that three European species of pine-feeding sawflies, *Diprion polytomum* (Hartig), *D. frutetorum* (Fabricius), and *Neodiprion sertifer* (Geoffroy), have become established in North America has greatly increased the interest in the parasites of the sawflies of this group. In an effort to control these pests several European species of parasites have been released in eastern Canada and New England, among them the following four species of the ichneumonid genus *Exenterus* Hartig: *marginatorius* (Fabricius), *abruptorius* (Thunberg), *adpersus* Hartig, and *tricolor* Roman.

During the same period a number of native species of *Exenterus* have been reared from various species of *Neodiprion*, among them the three new species described herein.

This study has been greatly facilitated by use of specimens of Palaearctic species generously sent the writer by the Dominion Parasite Laboratory at Belleville, Ontario. In this material the following seven species are recognized: *abruptorius* (Thunberg), *oriolus* Hartig, *tricolor* Roman, *adpersus* Hartig, *marginatorius* (Fabricius), *claripennis* Thomson, and one that cannot be reconciled with any described species and is described below as a new species.

Although recent reports from the Belleville laboratory record *Exenterus adpersus* as having been released and as having established

¹ Order Hymenoptera, family Ichneumonidae.

itself in the eastern Provinces as a parasite of *Diprion polytomum*, the writer has seen no specimen of the species reared from sawfly larvae collected in Canada. Apparently these records refer properly to *marginatorius*, especially since the only specimens of that species among those received from Canada that were reared from Canadian material and also a large series of specimens received earlier from the same source through the Northeastern Forest Insect Laboratory of the Bureau of Entomology and Plant Quarantine are labeled "*adspersus*."

To facilitate recognition of the species, including the introduced forms and those that may later be introduced, the following key is presented.

KEY TO SPECIES

1. Tarsi short and stout, distinctly depressed, especially in female; hind tarsus in female distinctly shorter than tibia, in male scarcely so long as tibia; flagellum black, with basal two or three joints usually yellow laterally-- 2
Tarsi slender and nearly or quite cylindrical (slightly flattened in female of *lophyrus*); hind tarsus fully as long as tibia; flagellum reddish below, black above----- 3
2. Antenna in female much shorter than abdomen, all flagellar joints beyond middle definitely thicker than long, in male barely as long as abdomen, subapical joints about as thick as long; front and middle femora in female usually entirely yellow, rarely, as in male, slightly stained behind with piceous----- *diprionis* Rohwer, p. 4.
Antenna in female fully as long as abdomen, most of the flagellar joints as long as thick, in male longer than abdomen, with all flagellar joints definitely longer than thick; front and middle femora definitely black behind----- *affinis* Rohwer, p. 5.
3. Eye much shorter than width of face; mesoscutum coarsely and confluent punctate; a large species, 10 mm. or more----- *lophyrus* Viereck, p. 5.
Eye nearly or quite as long as width of face; mesoscutum with finer, distinct punctures; smaller species, usually less than 10 mm----- 4
4. Basal carina of propodeum distinct----- 5
Basal carina of propodeum absent----- 12
5. Clypeus more or less distinctly transversely impressed before the strongly rounded and reflexed apex; abdomen narrow, tergite 2 nearly or quite as long as broad at base; antenna 35-jointed or more, in female much more than half as long as body, in male nearly as long as body; claws in female not pectinate----- 6
Clypeus broadly rounded at apex and neither transversely impressed nor reflexed; abdomen broad, tergite 2 much broader at base than long (in female nearly twice as broad as long); antenna less than 35-jointed, in female barely half as long as body, in male much shorter than body; claws in female pectinate----- 11
6. Abdomen laterally beyond tergite 3, genitalia, and hypopygium ferruginous; (hypopygium in female sharply folded along median line, ovipositor sheath strongly compressed, broad, bluntly rounded at apex) (fig. 1, B)----- *tricolor* Roman, p. 5.
Abdomen not at all ferruginous; hypopygium and genitalia black or yellow-- 7
7. Temple very strongly convex, not sloping from margin of eye, but usually reaching outside tangent of eye, nearly as long as short diameter of eye; hypopygium of female acute at apex and sharply folded along median line, yellow (fig. 1, A); ovipositor sheath strongly compressed, very broad; nervellus broken far below middle and strongly inclivous; mesosternum in female usually largely yellow; front and middle femora in female entirely yellow (rarely middle femur with a brownish streak behind), in male black only behind; hind femur in female usually, and in male frequently, yellow along lower part of outer side; hind trochanter entirely yellow----- *adspersus* Hartig, p. 6.
Temple sloping slightly from eye margin, not reaching outside tangent of eye, much shorter than short diameter of eye; hypopygium of female blunt at apex, not sharply folded, black or piceous, sometimes margined with yellow (fig. 1, C and D); ovipositor sheath less strongly compressed, and

narrower; nervellus usually broken at or near middle and not strongly inclivous; mesosternum in female largely or entirely black, at most with two small spots posteriorly; front and middle femora broadly black behind; hind femur entirely black; basal joint of hind trochanter usually more or less black basally----- 8

8. Propodeum with a strong median carina in petiolar area extending forward to apical carina, which is curved or angulated backward at this point; yellow margin of tergite 1 longest laterally; tergite 2 punctate, with deep, foveolate, oblique grooves basally; nervellus broken below middle and strongly inclivous----- *hullensis* Provancher, p. 7.

Propodeum without such a carina, apical carina usually straight medially; yellow of first tergite longest medially; tergite 2 rugose, the rugosity extending across the shallow, oblique grooves; nervellus broken near middle and nearly or quite perpendicular----- 9

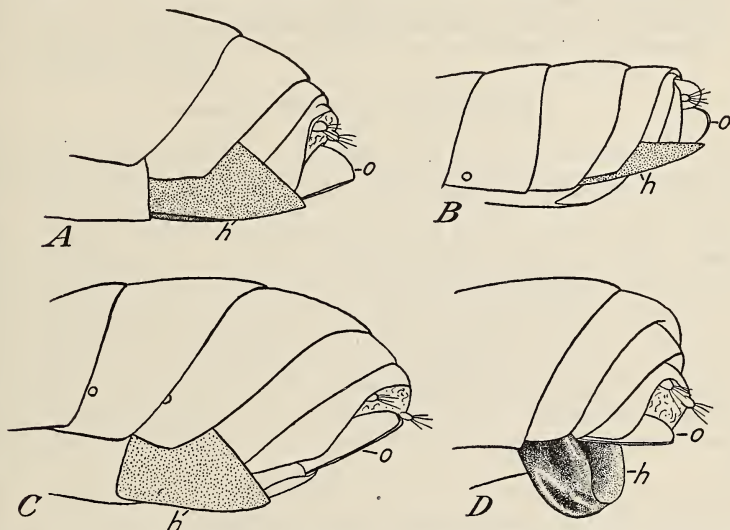


FIGURE 1.—Apex of abdomen of female: A, *Exenterus adspersus*; B, *E. tricolor*; C, *E. marginatorius*; D, *E. vellicatus*. h, Hypopygium; o, ovipositor sheath.

9. Hypopygium in female (fig. 1, D) pinched ventrally near apex, its lower margin in profile very strongly curved, its apex thin, wavy, flaring, broadly white; mesosternum posteriorly and hind coxae ventrally usually marked with yellow; front and middle coxae in male entirely yellow below

Hypopygium in female (fig. 1, C) not pinched, its lower margin in profile weakly curved, its apex thick, not wavy or flaring, at most very narrowly white margined; mesosternum and hind coxa entirely black; front and middle coxae in male with much black below----- 10

10. Stout; head hardly broader than thorax; prepectus with a more or less distinct scrobe for reception of front coxae, the scrobe set off laterally by carinae which usually form a pair of toothlike projections near apical margin; tergites 1 and 2 very broadly margined with yellow, less broadly in male

marginatorius (Fabricius), p. 8.
More slender; head distinctly broader than thorax; prepectus without such a scrobe and with at most traces of carinae; tergites 1 and 2 more narrowly margined with yellow, frequently almost entirely black in male

- claripennis* Thomson, p. 9.
11. Abdomen in female more than half, and mesosternum entirely, black; yellow of first tergite not or little wider laterally than medially

abruptorius (Thunberg), p. 9.
Abdomen in female more than half yellow, mesosternum conspicuously yellow marked; yellow of first tergite extending far toward base laterally

- oriolus* Hartig, p. 10.
12. Propodeum coarsely, reticulately rugose in basal middle----- 13
Propodeum punctate in basal middle----- 14

13. Tergites 1 and 2 very coarsely and irregularly rugose, 3 coarsely punctate; yellow markings very large, metapleurum in female with a large yellow spot; yellow margin of tergite 2 in male broader than that of tergite 3

flavissimus, new species, p. 12.

Tergites 1 and 2 more finely rugose, 3 more finely punctate; yellow markings of thorax much smaller, metapleurum immaculate in both sexes; yellow margin of tergite 2 in male usually narrower than that of 3 and sometimes absent.

canadensis Provancher, p. 10.

14. Apical carina interrupted or obsolescent medially; eye not obviously longer than width of face; tegula entirely yellow in female, yellow at base in male; mesopleural yellow spot in female very large and with two narrow extensions posteriorly; tergites 1-6 in male conspicuously yellow apically

pini, new species, p. 13.

Apical carina complete; eye obviously a little longer than width of face; tegula in female yellow at most basally, in male entirely black; mesopleural yellow spot in female small and without extensions; tergites 1 and 2 in male yellow at most in apical angles, 3-5 very narrowly yellow apically

tsugae, new species, p. 13.

EXENTERUS DIPRIONIS Rohwer

Exenterus diprioni Rohwer, U. S. Natl. Mus. Proc. 49: 222, 1915; 57: 225, 1920; Middleton, Jour. Agr. Research 20: 757, 1921; Hutchings, Quebec Soc. Protect. Plants Ann. Rept. 18: 115, 1926; Walley (in part), Canad. Ent. 65: 259, 1933.

Walley, in the place cited above, synonymized *affinis* Rohwer with *diprionis*. The present writer believes that the two species are distinct and can be distinguished by the characters used in the above key to species. In addition, *diprionis* is much more extensively yellow, the scutellum being entirely yellow, the spot on the mesopleurum in the female occupying approximately one-fourth of the surface, and the other markings being proportionally large; whereas in *affinis* the scutellum is usually more or less black at base, the pleural spot in both sexes is much smaller, and the other markings proportionally small.

Walley has called attention to the strikingly short, depressed tarsi of the female of this species, a character that immediately distinguishes it and *affinis* Rohwer from all other species of the genus. He has also given some characters for the previously undescribed male.

The male differs from the female, in addition to its more slender and less flattened tarsi, by the characters, usual in the genus, of longer antennae with relatively longer joints, narrower abdomen, nonpectinate claws, and smaller yellow markings.

The specific name is here emended to the proper genitive form.

In addition to the unique type female, which was reared October 3, 1912, at Tomahawk Lake, Wis., from *Neodiprion lecontei* (Fitch), under Hopkins U. S. No. 10109, the following specimens are in the National Museum collection: One female labeled "Hopk. U. S. 1367a," the significance of which label the writer has been unable to discover; one female reared July 21, 1914, at Tomahawk Lake, Wis., from *N. lecontei* on *Pinus strobus* under Hopkins U. S. No. 10729b; two females and one male reared September 1, 1917, and February 4, 1918, at Shreveport, La., from *Neodiprion* sp. on pine, under Hopkins U. S. No. 13662a; one female reared October 29, 1928, at Concord, N. C., by M. H. Davis, from a sawfly larva on deodar; and one female reared by the writer from a cocoon of ?*Neodiprion fabricii* (Leach) on *P. palustris* received from H. R. Johnson, Charleston, S. C. Also available for study is a female from the Canadian national collection, taken at Biscotasing, Quebec, September 6, 1930, by K. E. Schedl.

EXENTERUS AFFINIS Rohwer

Exenterus affinis Rohwer, U. S. Natl. Mus. Proc. 57: 225, 1920.

Exenterus canadensis Rohwer (not Provancher), U. S. Natl. Mus. Proc. 57: 225 (in key), 1920.

Exenterus diprioni Rohwer: Walley (in part), Canad. Ent. 65: 259, 1933.

Walley synonymized this species with *diprionis* Rohwer, but the present writer considers it distinct. It has the antennae definitely longer in both sexes than has *diprionis*; the sculpture of the abdomen, especially of the second tergite, somewhat finer; the yellow markings smaller; and the front and middle femora definitely black behind.

The differences between the sexes in *affinis* are much the same as in *diprionis*.

In addition to the unique type female, which was reared May 18, 1915, from a cocoon of *Neodiprion* sp. on *Pinus resinosa* in Maine, under Hopkins U. S. No. 12070f, the following specimens are before the writer: One female labeled simply "Hopkins U. S. No. 17501r," which probably indicates that it was reared, together with a considerable series of *Exenterus canadensis*, from *N. banksianae* Rohwer at Osage, Minn., by S. A. Graham; one female reared June 1, 1932, from *Neodiprion* sp. on *P. resinosa* at Lincoln, Maine; one female from "sawfly on pine" at Weaverville, N. C., E. V. Harbeck; one male, Biscotasing, Ontario, September 6, 1930, K. E. Schedl; one female from "sawfly on pine," July 29, 1932, Mount Desert, Maine; and one male from Quebec Province. The writer has also seen a female from the Canadian national collection taken June 18, 1937, at Maltawi (?), Ontario, by C. E. Atwood.

The last-mentioned male specimen was compared with the supposed allotype female of *canadensis* Prov. by Rohwer and labeled "homotype" by him. The status of this specimen is discussed fully under *canadensis* on a later page of this publication.

EXENTERUS LOPHYRI Viereck

Exenterus lophyri Viereck, U. S. Natl. Mus. Proc. 39: 404, 1911; Rohwer, U. S. Natl. Mus. Proc. 57: 225, 1920; Walley, Canad. Ent. 65: 259 (key), 1933.

This species remains known only from the four females of the type series. It is very distinct in its large size, broad face, coarsely and densely punctuate mesoscutum, almost evenly sculptured propodeum, and partly red femora. Rohwer and Walley state in their keys to species that the first and second tergites are sculptured like the third. This is not quite true, although the contrast in the coarseness of the sculpture is distinctly less in this species than is normal.

Rohwer has corrected the host record from *Lophyrus townsendi* to *Neodiprion* (*Zadiprion*) *grandis* (Rohwer).

EXENTERUS TRICOLOR Roman

(Fig. 1, B)

Exenterus tricolor Roman, Ent. Tidskr. 34: 127, 1913; Morris, Cameron, and Jepson, Bull. Ent. Research 28: 369, figs. 14, 15g, 16g, 1937.

This European species has been reported as having been released in eastern Canadian spruce forests infested by *Diprion polytomum*, but no report of its recovery has come to the writer's attention.

Three specimens of each sex, reared from *Diprion polytomum* from Czechoslovakia, have been sent to the writer by the Dominion Parasite Laboratory.

It is a slender, rather finely sculptured species, easily recognizable by the ferruginous color of the sides of the abdomen beyond the third tergite and of the hypopygium and genitalia.

EXENTERUS ADSPERSUS Hartig

(Fig. 1, A)

Exenterus adpersus Hartig, Jahresber. Fortschr. Forstw. 1: 271, 1838; Ratzeburg, Die Ichneumoniden der Forstinsecten, v. 1, p. 108, 1844; Roman, Ent. Tidskr. 34: 126-127, 1913.

Tryphon (Exenterus) adpersus (Hartig) Ratzeburg, Die Ichneumoniden der Forstinsecten, v. 2, p. 112, 1848; v. 3, p. 121, 1852.

Exenterus lepidus Holmgren, Svensk. Vet.-Akad. Handl. 1: 231, 1855.

Cteniscus adpersus (Hartig) Brischke, Schr. Phys. Ökonom. Gesell. Königsberg 11: 97, 1870.

Cteniscus lepidus (Holmgren) Brischke, Schr. Naturf. Gesell. Danzig, n. f. 4: 104, 1878.

Exenterus laricinus Thomson, Opuscula Entomologica, fasc. 12, p. 1254, 1888; Schmiedeknecht, Opuscula Ichneumonologica, fasc. 30, p. 2302, 1912. (New synonymy.)

Exenterus oleaceus Uchida, Insecta Matsumurana 5: 146, 1931. (New synonymy.)

Despite the fact that Hartig did not mention the very conspicuously yellow mesosternum in the female, the writer follows Roman in identifying as *adpersus* the species so characterized. He cannot, however, agree with Roman that *claripennis* Thomson is probably synonymous with, and *laricinus* Thomson distinct from, *adpersus*. It seems evident from the original description of *laricinus* that it belongs here, whereas *claripennis* is distinct from *adpersus* in its black-marked front and middle femora and supposedly black mesosternum.

The present synonymizing of *oleaceus* Uchida is based on a comparison of Japanese with European specimens.

Of this species the following material has been examined: One female and three males from Karislojo, Finland, identified by R. Forsius as *adpersus*, one of the males bearing the host label "ex *Lophyrus pini* larva"; three females received from the Dominion Parasite Laboratory and reared from *Diprion polytomum* from Czechoslovakia; two females from the same laboratory reared from *Diprion simile* Hartig from Poland; two females and five males reared from *Neodiprion sertifer* in Japan; six of each sex reared from *Diprion nipponicum* Rohwer, two of each sex in Japan and the others sent the writer by the Dominion Parasite Laboratory; also one female collected in Chosen (Korea) by T. R. Gardner.

From its closest relatives this species can be distinguished by its relatively broader temples, and in the female by its largely yellow mesosternum, entirely yellow front and middle femora, yellow lower half of the outer surface of the hind femur, and yellow, sharply folded hypopygium. The male, in which the mesosternum, the posterior faces of the front and middle femora, and frequently the entire hind femur are black, can still be distinguished by the broad temples and entirely yellow trochanters.

Prior to 1936 all published statements of the establishment of a species of *Exenterus* in connection with control work on *Diprion polytomum* in Canada used the name *marginatorius*. Subsequent to

that year *marginatorius* has been replaced by *adpersus*. The writer has seen no published explanation for this switch in names. As stated in the introduction, all the specimens reared from Canadian material and bearing the name *adpersus* that have been examined by the writer are definitely *marginatorius*. It therefore is evident that all American references to *adpersus* should be listed under *marginatorius*, as has been done in this publication.

EXENTERUS HULLENSIS Provancher

Exenterus hullensis Provancher, Additions et Corrections au Volume II de la Faune Entomologique du Canada Traitant des Hyménoptères, p. 104, 1886; Rohwer, U. S. Natl. Mus. Proc. 57: 226, 1920; Walley, Canad. Ent. 65: 259, 1933. *Picroscopus hullensis* (Provancher) Davis, Amer. Ent. Soc. Trans. 24: 230, 1897.

Easily distinguished from all the other North American species by the distinct basal carina of the propodeum, and allied by this same character to all the European species that the writer has seen. From these it is sufficiently distinguished by the characters used in the key to species.

Of *hullensis* the writer has seen the following specimens: One male from Quebec compared with the type by the late W. Hague Harrington and presented by him to the United States National Museum; one male, Intervale, N. H., July 4, 1927, S. Albert Shaw; and six females and two males, kindly lent the writer by G. Stuart Walley from the Canadian national collection, taken at various dates from June to August and at several localities in Quebec.

EXENTERUS VELLICATUS, new species

(Fig. 1, D)

?*Exenterus* sp., Morris, Cameron, and Jepson, Bull. Ent. Research 28: 377, fig. 14c, 1937.

As indicated above, it is suspected that this is the species discussed by Morris, Cameron, and Jepson as "*Exenterus* sp." It is a rather slender species very similar in general form to *tricolor* and *claripennis*, especially in the receding temples and the distinctly sloping (not perpendicular) posterior face of the propodeum. From those two species it may be distinguished by the very different form of the hypopygium, and from *tricolor* also by the entire lack of ferruginous on the abdomen.

Female.—Length 6–7 mm. Head slightly broader than thorax, temple distinctly though not strongly receding from margin of eye; vertex, frons, temple, and face rather densely punctate; eye hardly so long as width of face; malar space about half as long as basal width of mandible; clypeus transversely impressed before its strongly rounded apex; upper tooth of mandible longer than lower tooth; antenna 34-jointed, about as long as abdomen.

Thorax less densely and more finely punctate than head; propodeum unusually weakly sculptured, lateral and pleural areas indistinctly so and shining, areola and petiolar area transversely, irregularly striate, costulae distinct; claws not pectinate; nervellus broken at or slightly below middle and nearly or quite perpendicular.

Abdomen rather narrow, tergite 1 much longer than broad at apex, 2 about as long as broad at base, 1 and 2 irregularly, longitudinally rugulose, 3 densely; finely punctate, others successively less distinctly punctate; hypopygium in profile with ventral margin very strongly curved, pinched just before apex, apical margin flaring, thin and wavy.

Black, with antenna ferruginous below and with following parts yellow: Face, except median line, frontal orbits, scape below, clypeus, mouth parts, malar

space, and cheeks; anterior margin of pronotum and sometimes a spot at upper end of each epomia; propleurum in front; triangular spot on each side of anterior margin of mesoscutum and sometimes two small discal spots; scutellum and post-scutellum; subalar tubercle; spot at upper end of prepectus and a streak along sternaulex; paired spots at posterior margin of mesosternum; large spot on metapleurum confluent with a spot occupying most of middle pleural and middle lateral areas of propodeum; front and middle coxae largely, their trochanters entirely, femora in front, tibiae except dark streaks on their flexor surfaces, and basitarsi largely; hind coxa below, trochanter largely, broad annulus on tibia, and basitarsus except at apex; broad apical bands on tergites 1 and 2 and much narrower and shorter ones on tergites 3-5; broad apical margin of hypopygium; and venter except small sternites; wings hyaline, venation black.

Male.—Differing from female principally in extent of yellow markings, some of the smaller markings usually lacking as also the spot on propodeum and metapleurum; apical bands of tergites much narrower, those of tergites 3-5 sometimes absent. The darkest males resemble very closely the males of *claripennis*, but can be distinguished by the almost entirely yellow front and middle coxae.

Host.—*Diprion polytomum* (Hartig).

Type locality.—Czechoslovakia.

Type, allotype, and paratypes.—Canadian national collection.

Paratypes.—United States National Museum No. 53069.

Described from 9 females and 10 males reared during 1936 and 1937 from imported cocoons of the host at the Dominion Parasite Laboratory under No. 18111, and one female received many years ago from Germany and erroneously identified by Schmiedeknecht as *marginatorius*.

EXENTERUS MARGINATORIUS (Fabricius)

(Fig. 1, C)

Ichneumon marginatorius Fabricius, Entomologia Systematica, v. 2, p. 145, 1793.

Ichneumon amictorius Panzer, Fauna Insectorum Germaniae, heft 80, pl. 14, 1801.

Cryptus marginatorius Fabricius, Systema Piezatorum, p. 76, 1804.

Ichneumon sulcatorius Thunberg, Mem. Acad. Sci. St. Petersburg 8: 279, 1822; 9: 359, 1824.

Tryphon marginatorius (Fabricius) Gravenhorst, Ichneumonologia Europaea, v. 2, p. 191, 1829.

Exenterus marginatorius (Fabricius) Hartig, Jahresber. Fortschr. Forstw. 1: 270, 1838; Ratzeburg, Die Ichneumoniden der Forstinsecten, v. 1, p. 107, pl. 6, fig. 11, 1844; Holmgren, Svensk. Vet.-Akad. Handl. 1: 230, 1855; Roman, Zool. Bidr. Uppsala 1: 281, 1912; Schutze and Roman, Isis Budissina 12: 7, 1931; Finlayson and Reeks, Canad. Ent. 68: 166, 1936; Balch, Nova Scotia, Rept. Dept. Lands and Forests, 1935, p. 95, 1936; Forestry Chron. 12: 151, 1936; Pulp and Paper Mag. Canada 37: 334, 1936; Morris, Cameron, and Jepson, Bull. Ent. Research 28: 376, 1937.

Tryphon (Exenterus) marginatorius (Fabricius) Ratzeburg, Die Ichneumoniden der Forstinsecten, v. 2, p. 112, 1848.

Exenterus adspersus Baird (not Hartig), Pulp and Paper Mag. Canada 39: 298, 1938.

In the above citations only the more significant references are entered.

The very broad yellow apical bands on tergites 1 and 2 will serve to distinguish this species from the other species with distinct basal carina on propodeum, with the exception of *hullensis*, in which, however, the yellow of tergite 1 is prolonged laterally nearly to the base, whereas in *marginatorius* it is usually longest in the middle. From all but *abruptorius* the usually very strong carina on the prepectus will distinguish it; in *abruptorius*, in which this carina is also usually strong, the tergites are much broader and the abdominal bands of more nearly uniform length than in *marginatorius*.

This is the only one of the exotic species released in North America which appears to have become established; at least it is the only one

of which the writer has seen specimens reared from North American host material. Apparently the encouraging recovery records published in Canadian literature in which the name *adspersus* Hartig is used apply properly to *marginatorius*.

Of this species the writer has examined six females and two males from Europe identified by Schmiedeknecht, Roman, Pfankuch, and Habermehl; nine females and six males reared from *Diprion polytomum* in Canada and received from the Dominion Parasite Laboratory through the Northeastern Forest Insect Laboratory of this Bureau; two of each sex from the same host but received direct from the Dominion Laboratory; and two of each sex reared from *D. simile* Hartig from Poland, also received from the Dominion Laboratory. The last three series mentioned are labeled "*Exenterus adspersus*."

EXENTERUS CLARIPENNIS Thomson

Exenterus claripennis Thomson, Opuscula Entomologica, fasc. 9, p. 887, 1883.
?Exenterus adspersus Morris, Cameron, and Jepson, Bull. Ent. Research 28: 375, 1937.

What the writer takes to be this species is represented in the material received from the Dominion Parasite Laboratory by two specimens of each sex reared from *Diprion polytomum* in Sweden and three of each sex reared from the same host in Czechoslovakia.

As thus represented it is very like a small, slender *marginatorius* without the carina on the prepectus, with the posterior face of the propodeum precipitous but not perpendicular as it is in *marginatorius*, and with the yellow markings fewer and much smaller, especially on the abdomen, where the markings on tergites 1 and 2 are much reduced and those on the other tergites are frequently lacking.

This is probably the form identified as *adspersus* by Morris, Cameron, and Jepson.

EXENTERUS ABRUPTORIUS (Thunberg)

Ichneumon abruptorius Thunberg, Mem. Acad. Sci. St. Petersburg 8: 279, 1822; 9: 360, 1824.

Exenterus cingulatorius Holmgren, Svensk. Vet.-Akad. Handl. 1: 229, 1855; Thomson, Opuscula Entomologica, fasc. 9, p. 887, 1883; Schönwiese, Ztschr. Angew. Ent. 21: 489-491, figs. 14-15, 1934.

Exenterus abruptorius (Thunberg) Roman, Zool. Bidr. Uppsala 1: 232, 1912; Kerrich, Soc. Brit. Ent. Trans. 2: 42-43, 1935; Morris, Bull. Ent. Research 28: 525-534, 1937.

Exenterus coreensis Uchida, Jour. Fac. Agr. Hokkaido Imp. Univ. 25: 270, Pl. V, fig. 9, 1930; Clausen, Ent. Soc. Wash. Proc. 34: 57, pl. 6, fig. C, pl. 7, fig. D, 1932. (New synonymy.)

From all the other species with the basal carina of the propodeum distinct, except *oriolus* Hartig, this species differs in its distinctly stouter abdomen, the second tergite being nearly twice as broad as long in the female and much broader than long in the male, whereas in the other species it is relatively much narrower. Also, the yellow bands on the abdomen are of more nearly the same width than in any of the other species.

This species is reported to have been released in eastern Canada in the attempt to control *Diprion polytomum*, but apparently has not been recovered. It has also been released in New Hampshire, Vermont, Connecticut, and New York against both *D. polytomum* and *Neodiprion sertifer*, but no report of its recovery has been seen by

the writer. In Europe it apparently prefers *N. sertifer* as host, but has also been reported from *D. pini* (L.).

Of *abruptorius* the writer has seen two European specimens, a female and a male, the latter misidentified by Schmiedeknecht as *marginatorius*; five females and three males received from the Dominion Laboratory, all reared from *Neodiprion sertifer*, two of the females from Japan, the rest from Hungary; one male from Chosen, received from Uchida and identified by him as *coreensis* Uchida; and 10 females and 21 males received from the Dominion Parasite Laboratory through the Northeastern Forest Insect Laboratory of this Bureau, all but one male reared from *N. sertifer*, the one exception reared from *Diprion polytomum*.

EXENTERUS ORIOLUS Hartig

Exenterus oriolus Hartig, Jahresber. Fortschr. Forstw. 1: 270, 1838; Vollenhoven, Pinacographia, p. 66, pl. 42, fig. 9, 1880; Schönwiese, Ztschr. Angew. Ent. 21: 491, 1934.

Tryphon (Exenterus) oriolus (Hartig) Ratzeburg, Die Ichneumoniden der Forstinsecten, v. 2, p. 112, 1848; v. 3, p. 121, 1852.

Cteniscus oriolus (Hartig) Brischke, Schr. Phys. Ökonom. Gesell. Königsberg, 11: 98, 1870; Schr. Naturf. Gesell. Danzig, n. f. 4: 104, 1878.

Of this species a female and a male identified by Schmiedeknecht and one female reared from *Neodiprion sertifer* in Hungary and received from the Dominion Parasite Laboratory have been examined.

Except for the much greater extent of yellow nothing is found by which to distinguish it from *abruptorius*, and it may be a color form of that species.

EXENTERUS CANADENSIS Provancher

Exenterus canadensis Provancher, Nat. Canad. 14: 9, 1883; Petite Faune Entomologique du Canada, Hyménoptères, 1883, p. 796, male (not female); Walley, Canad. Ent. 65: 258, 1933.

Picroscopus canadensis (Provancher) Davis, Amer. Ent. Soc. Trans. 24: 229, 1897.

Exenterus nigrifrons Rohwer, U. S. Natl. Mus. Proc. 57: 225, male (not female), 1920; Walley, Canad. Ent. 65: 258 (in discussion of *canadensis* Prov.) and 260 (in key), 1933. (New synonymy.)

The holotype male of this species apparently has disappeared, since neither S. A. Rohwer nor G. Stuart Walley was able to find it in the Provancher collections. Both found a female, with which Rohwer compared a male from the National Museum, which he evidently considered to be the same species, for he labeled it "homotype." Walley compared with Provancher's female a female of *diprionis* Rohwer and has stated (in litt.) that the supposed allotype female of *canadensis* is the same as *diprionis*, citing the short, flattened tarsi, yellow basal joints of flagellum, and entirely yellow front and middle legs. Both Rohwer and Walley have published keys to the North American species including *canadensis*, Rohwer basing his conception of the species on his "homotype" male and Walley his on specimens determined by himself prior to his examination of Provancher's female. Davis' description of *canadensis* is evidently not based on the holotype, for he describes yellow spots on the "anterior mesopleurae," nor on Provancher's female, for he describes the antennae as dark brown and the front and middle femora as being piceous posteriorly and does not mention the very large yellow spot on the pronotum characteristic of *diprionis*. His description fits very well some specimens of the species

originally referred by Walley to *canadensis*. Many male specimens of this species fit the original description better than anything else in the genus.

It is the writer's opinion that the holotype male and Provancher's female are not conspecific, that Rohwer's "homotype" of *canadensis* is the male of *affinis* Rohwer, which Walley erroneously synonymized with *diprionis* Rohwer, that Davis and Walley were dealing with the same species under the name *canadensis*, and that, in view of the apparent disappearance of the holotype, the species represented by the published identifications of the first and second revisers, Davis and Walley, should be recognized as *canadensis* Prov. This is the species here so treated.

It is interesting to note that in the original description of *canadensis* there is an apparent omission. Of the legs the description says: "Pattes jaunes, les hanches noires, les 4 antérieures jaunes en dessous, les 4 cuisses antérieures noires en dessus de même que l'extrémité de leurs jambes." This calls for entirely yellow hind femur and tibia and black-tipped front and middle tibiae, the first of which occurs in no species of the genus and the latter of which is rare. It is evident that some such expression as *les cuisses postérieures noires* was omitted between the words "dessus" and "de même."

Walley has called attention to the fact that the type of *nigrifrons* is male, not female as originally recorded, and has discussed its possible synonymy with *canadensis* Prov. The writer finds no means of distinguishing it from *canadensis*.

This and the three new species described below form a group of very closely related forms, which may prove to be geographical or host races of a single species; but in the material available for study the characters of sculpture and color pattern seem too constant to permit that conclusion. The coarse reticulation of the basal middle of the propodeum of the first two is quite different from the punctation of the others, while the much coarser sculpture of the abdomen and much larger yellow markings of the next following species (*flavissimus*, n. sp.) apparently will distinguish it without difficulty from *canadensis*.

Because of the uncertainty of the true identity of *canadensis* and to remove any doubt as to the form here treated under that name it seems advisable to present a rather detailed description.

Female.—Length 6–9 mm. Head nearly as broad across temples as across eyes; eye as long as width of face, very faintly emarginate opposite antenna; malar space less than half basal width of mandible; antenna fully as long as abdomen, 35-jointed, tapering, all flagellar joints at least a little longer than thick.

Thorax rather coarsely punctate, more finely and densely so on mesoscutum than on pleurum, pronotum laterally finely and rather sparsely punctate, scutellum more coarsely punctate than scutum; propodeum rugose, most coarsely so in basal middle, costulae absent, apical carina complete, areola obscurely defined; tarsal claws pectinate.

Abdomen broad, tergite 2 nearly twice as broad at base as long medially, with only faint indications of oblique grooves at base; tergites 1 and 2 rugulose, 3 finely and evenly punctate.

Black with yellow markings as follows: Face except sometimes a narrow median line; clypeus, mandible in middle, inner orbit to lateral ocellus, a narrow median spot on frons, malar space, outer orbit nearly to top of eye, anterior margin of pronotum and a small spot each side of middle, and cuneiform spot on each side of mesoscutum anteriorly; scutellum and its basal carinae and postscutellum, tegula basally (apex piceous), subalar tubercle, and a small vertical spot below it and sometimes small spots on posterior ventral margin of prepectus, spot on each side of

propodeum just before carina, and apical margins of tergites 1-6, that of tergite 1 broader laterally than medially, that of tergite 2 occupying about a fourth of length of tergite and little broader than that of 3; venter largely yellow, hypopygium reddish yellow. Antenna ferruginous, black toward base above, scape and pedicel yellow below. Wings hyaline with an obscure fuscous spot at apex of front wing, venation black, stigma light brown. Front and middle legs yellow, coxae black behind, femora piceous posteriorly; hind leg black, second joint of trochanter and first partly, sometimes a spot on ventral face of coxa, tibia except apical third or more, and base of basitarsus yellow; tarsus elsewhere reddish.

Male.—Differing from female in the usual sexual characters, especially in the less extensive yellow markings. Sometimes (as in type of *nigrifrons*) the face is yellow only along orbits; rarely the frontal, mesopleural, and propodeal spots are missing. The apical band of tergite 2 is usually narrower medially than that of 3 and is rarely absent.

Undersized males are sometimes difficult to place on the sculptural characters used in the key.

Of this species the writer has seen 19 females and 20 males (including the type of *nigrifrons*), about half of them reared under Hopkins' U. S. No. 17501p, from *Neodiprion banksianae* Rohwer, on June 30, 1924, at Osage, Minn., by S. A. Graham. Other reared series are from *Neodiprion* sp., Lincoln, Maine, June 16, 1932; and from a tenthredinid at Groton, Mass., May 25, 1937, under Northeastern Forest Insect Laboratory No. 364-203-37 and No. 364-205-36. Collected specimens are labeled as follows: Cranmoor, Wood Co., Wis., July 20, 07, C. B. Hardenberg; Lake Vadnais, St. Paul, Minn., June 4, 1929, L. W. Orr; and Marquette, Mich., June 26.

EXENTERUS FLAVISSIMUS, new species

Very closely related to *canadensis* Prov., and differing from that species principally as follows:

Female.—Length 6.5-10 mm. More coarsely sculptured throughout, most noticeably so on mesoscutum, where punctures are nearly contiguous, and on abdomen, where tergites 1 and 2 are very coarsely rugose and the others coarsely punctate; temples a little more strongly receding.

All yellow markings much larger; frontal spot diamond-shaped or ovate; frequently a small spot on each side behind ocelli; propleura more or less yellow apically; cuneiform marks of mesoscutum reaching nearly or quite to tegulae and with narrow extensions onto disk along normal positions of notaulices; mesopleural spot very large and frequently confluent below with the broad yellow margin of the prepectus, from which short streaks extend along the sternaules; mesosternum with a triangular yellow spot posteriorly; propodeal spots each covering nearly entire lateral area except about spiracle and embracing the apical carina; metapleurum with a large yellow spot along dorsal margin adjacent to propodeal spot; front and middle coxae almost entirely, entire under surface of hind coxa, and frequently one or two spots dorsally, yellow; hind trochanter entirely yellow; hind tibia black only at apical fourth and there reddish or yellow beneath; yellow bands of abdomen very broad, that of tergite 2 occupying a third or more of length of tergite.

Male.—Yellow markings smaller than in female, with those of vertex, sides of pronotum, prepectus, and mesosternum, and sometimes those of notaulices and hind coxae absent. From the male of *canadensis* it can always be distinguished by the entirely yellow hind trochanter and by having the yellow margin of tergite 2 broader than that of tergite 3.

Host.—*Neodiprion sertifer* (Geoffr.).

Type locality.—Bound Brook, N. J.

Type.—United States National Museum No. 53070.

Paratypes.—Canadian national collection.

Three females and five males (including holotype female and allotype male) reared August 30, 1937, under Northeastern Forest Insect

Laboratory No. 25-203-37-1; and three females and one male reared July 21-August 23, 1938, from *Neodiprion sertifer* at Lamington, N. J.

EXENTERUS PINI, new species

Related to *canadensis* and *flavissimus*, but distinct from both by the sculpture of the basal middle of the propodeum, which is punctate like the rest of the surface instead of rugose, and in having the apical carina of the propodeum poorly defined or interrupted medially. Also, the second tergite is more punctate than rugose.

Female.—Length 7-11 mm. Temples broad as in *canadensis*; eye not obviously longer than width of face, as it is in the following new species; antenna \pm 35-jointed.

Color as in *flavissimus* except as follows: Frontal spot sagittate; no spots behind ocelli; mesopleural spot with a narrow extension obliquely toward lower posterior angle of pleurum, where there is a small yellow spot; propodeal spot occupying only about apical half of lateral area; metapleural spot apical rather than dorsal; tegulae, except stramineous margin, yellow; hind femur more or less ferruginous toward apex and with a broad yellow stripe on outer lower side and usually a less distinct one toward apex dorsally; abdominal bands hardly so broad, but that of tergite 1 extending laterally to include the basal angles.

Male.—Differing from female as usual. All markings smaller, streaks along notaulices, prepectus, and sternaules lacking, as is the metapleural spot; mesopleural spot vertically oval without extension; hind coxa entirely and basal joint of trochanter, except narrowly at apex, black; hind femur almost entirely black or piceous, rarely reddish with trace of yellow pattern of female; yellow band of tergite 1 extending only a short distance toward base laterally.

Type locality.—Halsey, Nebr.

Type, allotype, and paratypes.—United States National Museum No. 53071.

Three females and five males, all but one of the females reared June 28, 1937, under Northeastern Forest Insect Laboratory No. 54-201-36-1, from cocoons of a tenthredinid collected in the Nebraska National Forest; the third female from Plainview, Jefferson County, Colo., July 9-14, 1927, 7,000-8,000 feet.

EXENTERUS TSUGAE, new species

Like *pini* this species has the basal middle of the propodeum punctate instead of rugose as in *canadensis* and *flavissimus*. From *pini* it may be distinguished as follows:

Female.—Length 4-7 mm. Antenna \pm 30-jointed; apical carina of propodeum strong throughout; eye obviously a little longer than width of face.

Color pattern like that of male of *pini* except that the streaks along the notaulices are indicated and the metapleural spot is rarely present. In a few depauperate individuals the abdominal bands are almost obliterated.

Male.—All markings of thorax and abdomen much reduced; always absent are the discal markings of the mesoscutum and the lateral spots of the pronotum, while the tegulae are entirely piceous and the scutellum is broadly black at base, frequently lacking are the yellow margin of the pronotum and the pronotal spots, all pleural and propodeal spots, and sometimes all abdominal markings, although normally two spots at the apex of tergite 1 and narrow apical bands on tergites 3-5 are present. In some minute specimens the face is black except the narrow orbits, the posterior orbits are yellow only below, the only yellow markings on the thorax are traces of the mesoscutal spots, the subalar tubercle, the apex of the scutellum, and the postscutellum, while the abdomen is entirely black.

Host.—*Neodiprion tsugae* Middleton.

Type locality.—Sweet Home, Oreg.

Type, allotype, and paratypes.—United States National Museum No. 53072.

Paratypes.—Canadian national collection.

Forty-six females and twenty-five males, all but one from the type locality and type host. Of these, five females and four males were reared in Oregon April 10 to May 16, 1936, by R. L. Furniss under Hopkins U. S. No. 31660-R; one female and one male with the same data except July 7, 1936, and Hopkins U. S. No. 31675-R. The rest were reared at the Northeastern Forest Insect Laboratory at New Haven, Conn., under its No. 51-201-36-2, June 17-28, 1936. The one other specimen was reared April 9, 1925, under Hopkins U. S. No. 17234B, at West Yellowstone, Mont., from a cocoon collected September 9, 1924, by J. C. Evenden.

ORGANIZATION OF THE UNITED STATES DEPARTMENT OF AGRICULTURE WHEN THIS PUBLICATION WAS LAST PRINTED

<i>Secretary of Agriculture</i>	HENRY A. WALLACE.
<i>Under Secretary</i>	CLAUDE R. WICKARD.
<i>Assistant Secretary</i>	GROVER B. HILL.
<i>Director of Information</i>	M. S. EISENHOWER.
<i>Director of Extension Work</i>	M. L. WILSON.
<i>Director of Finance</i>	W. A. JUMP.
<i>Director of Personnel</i>	ROY F. HENDRICKSON.
<i>Director of Research</i>	JAMES T. JARDINE.
<i>Director of Marketing</i>	MILO R. PERKINS.
<i>Solicitor</i>	MASTIN G. WHITE.
<i>Land Use Coordinator</i>	M. S. EISENHOWER.
<i>Office of Plant and Operation</i>	ARTHUR B. THATCHER, <i>Chief</i> .
<i>Office of C. C. C. Activities</i>	FRED W. MORRELL, <i>Chief</i> .
<i>Office of Experiment Stations</i>	JAMES T. JARDINE, <i>Chief</i> .
<i>Office of Foreign Agricultural Relations</i>	LESLIE A. WHEELER, <i>Director</i> .
<i>Agricultural Adjustment Administration</i>	R. M. EVANS, <i>Administrator</i> .
<i>Bureau of Agricultural Chemistry and En- gineering</i>	HENRY G. KNIGHT, <i>Chief</i> .
<i>Bureau of Agricultural Economics</i>	H. R. TOLLEY, <i>Chief</i> .
<i>Agricultural Marketing Service</i>	C. W. KITCHEN, <i>Chief</i> .
<i>Bureau of Animal Industry</i>	JOHN R. MOHLER, <i>Chief</i> .
<i>Commodity Credit Corporation</i>	CARL B. ROBBINS, <i>President</i> .
<i>Commodity Exchange Administration</i>	JOSEPH M. MEHL, <i>Chief</i> .
<i>Bureau of Dairy Industry</i>	O. E. REED, <i>Chief</i> .
<i>Bureau of Entomology and Plant Quarantine</i>	LEE A. STRONG, <i>Chief</i> .
<i>Farm Credit Administration</i>	A. G. BLACK, <i>Governor</i> .
<i>Farm Security Administration</i>	C. B. BALDWIN, <i>Administrator</i> .
<i>Federal Crop Insurance Corporation</i>	LEROY K. SMITH, <i>Manager</i> .
<i>Surplus Marketing Administration</i>	MILO R. PERKINS, <i>Administrator</i> .
<i>Forest Service</i>	EARLE H. CLAPP, <i>Acting Chief</i> .
<i>Bureau of Home Economics</i>	LOUISE STANLEY, <i>Chief</i> .
<i>Library</i>	CLARIBEL R. BARNETT, <i>Librarian</i> .
<i>Bureau of Plant Industry</i>	E. C. AUCHTER, <i>Chief</i> .
<i>Rural Electrification Administration</i>	HARRY SLATTERY, <i>Administrator</i> .
<i>Soil Conservation Service</i>	H. H. BENNETT, <i>Chief</i> .

This publication is a contribution from

<i>Bureau of Entomology and Plant Quarantine</i>	LEE A. STRONG, <i>Chief</i> .
<i>Division of Insect Identification</i>	C. F. W. MUESEBECK, <i>Principal Entomologist, in Charge</i> .

